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## Peridynamic bending and failure with nonordinary state-based models

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### ABSTRACT

Features that are much wider than they are thick, like thin plates, are numerically difficult to model with the material models that describe solid material behavior. In Finite Element Analysis, this problem is often handled by using 1D and 2D elements that resist bending without explicitly modeling thickness. Peridynamics is an alternate formulation of continuum mechanics that has shown great ability to model solid structures, but reduced-order peridynamic bending models remain underdeveloped. An example proposed by Silling in 2007 suggests a solution: a nonordinary, state-based peridynamic material model that directly resists bending deformation by resisting changes in the angles between peridynamic bonds. Unlike earlier peridynamic models that resist bond extension, this new model resists bending without using several nodes through the thickness of a thin feature. Beginning from the simplest beam, this material model is extended to plates and then the combined in-plane and bending deformation of simple shells. Because failure modeling is the main motivation for peridynamic modeling, a simple mechanism for brittle failure is also presented. The development of thin-feature models promises to extend the usability of peridynamic modeling to a broader class of problems.